has separately collected particulars of sixty-one spots, held, with more or less of probability, to have presented themselves afresh after making the circuit of the sun, and hence to be available as guides to the period and law of its rotation. From these data he constructed a curve (Plate XVI. Fig. 2) showing the variations in the rate of spot-displacement with varying latitude, the perfect symmetry of which on either side of the sun's equator testifies to the absence of any systematic difference in this respect between the hemispheres. From the curve were derived three distinct formulæ of the solar rotation, all fitting perfectly with the observations within the parallels of 30°, but diverging widely in their results for high latitudes. For example, No. I. gives for the region close to either pole a period of just 33 days; No. III. of a little over 40; No. II. of 55·8 days. From Carrington's formula, Dr. Braun deduces a polar period of 30·86 days; Faye's implies one of 32; Spörer's actually reverses the direction of change beyond the spot-zones, indicating a recovery of velocity towards the far north and south, and a period, in latitude 90°, of no more than 25·1 days—about the same which prevails in parallels of 10°. It may be worth remarking, as at least a coincidence, that almost precisely this rate of motion was inferred by Father Secchi (very doubtfully, it is true) from observations of relatively stable prominences near the pole. Nevertheless, a survey of the discrepancies tabulated by our author can hardly fail to inspire a profound distrust of empirical formulæ, and still more of the risky process termed "extrapolation."

The swiftest-moving spot noted by the Kalocsa observers was situated 1° 20′ north of the equator; its estimated daily displacement of 868′ bringing about the completion of its circuit in 24·88 days. The most sluggish was in south latitude 29° 38′, and gave a period of 26·5 days. As might have been expected, considerable irregularities are apparent; yet not more than might reasonably be set down to uncertainties of observation. A much higher degree of accuracy must, however, be reached before the mean rate of motion proper to each parallel can be at all satisfactorily ascertained. This mean rate is itself, in Spörer's view, subject to cyclical change; and his observations during the years 1861-1871, as compared with Carrington's during seven preceding years, disclosed persistent differences not easily accounted for. Dr. Braun's results, on the other hand, agree quite as well as could be expected with those of the English observer. A further complication is introduced by what may be called the individual caprices of spots. Each spot has probably a velocity of transport peculiar to itself, depending upon the circumstances of its origin; this velocity is certainly subject to accelerations connected with the processes of its development. These accelerations (for the change of motion is always in a *forward* direction) are shown, in Prof. Spörer's recent communication to the Physical Society of Berlin, to be very considerable; they are beyond question highly significant; yet they emphasise our disadvantage in being compelled to rely upon such unstable phenomena for all our knowledge regarding that most important datum—the rate of the sun's revolution on its axis.

The Kalocsa solar observations were made at a critical period. They cover the whole of the prolonged maximum which culminated near the close of 1883, and disclose or confirm very satisfactorily some of its characteristics. Dr. Braun has depicted in a remarkable curve the progressive changes in the mean latitude of the spot-zones during the years 1880-84. Their continuous approach to the equator at once strikes the eye; but superposed upon the line of uniform descent is a series of minor oscillations with a period of about a year, and an amplitude of fully 2°, which seem too regular and strongly-marked to be the mere effect of accident. This feature is quite novel and deserves attention.

The general rule that the long series of spots comprised within each cycle break out first in high latitudes, and become extinct close to the equator, was first observed by Carrington, and may now be regarded as fully established. Ordinarily, the maximum occurs when the mean latitude of the zones is 16° or 18°, the energy of the disturbance diminishing as they close further in. But the retarded character of the recent crisis was significantly attested by the fact that it did not reach its height until the closing in had proceeded much further than usual. In 1882, when the maximum was due, the average latitude of spots was (from Dr. Braun's curve) about 16°; whereas, at the close of 1883, when the maximum actually occurred, it was no more than 11°. It would seem as if the punctual and duly prepared completion of the outburst had been frustrated, and its stored-up energy spent upon an abnormal protraction of the maximum.

It might even be said that the perturbation thus indicated affected chiefly, or solely, the southern hemisphere of the sun. Although the respective sum-totals of spots observed at Kalocsa north and south of the equator eventually almost exactly balanced each other, large temporary discrepancies were manifest. The northern hemisphere displayed in 1880 an excess of activity, still more conspicuous in the ensuing year. Southern spots, on the contrary, outnumbered northern in 1882 to the extent of 8 per cent., and in 1883 in the proportion of nine to five. Dr. Braun adds the remark that each hemisphere would almost seem to have completed its cycle of change independently of the other, the northern maximum having occurred late in 1881, while the southern was postponed for two further years. The cause of perturbation should, in this view, be localised in the southern hemisphere.

A. M. CLERKE

NOTES

ON November 10 last, an important meeting of intercolonial delegates was held at the rooms of the Royal Society, Sydney, for the purpose of forming an Australasian Association for the Advancement of Science. There were delegates from all the principal scientific Societies of Australia, and they seem to have had no difficulty in arriving at a decision on the questions they had met to discuss. On the motion of the chairman, Mr. Russell, it was agreed that an association of the scientific Societies of Australasia should be formed under the name of "The Australasian Association for the Advancement of Science." It was also resolved that the rules of the British Association should be adopted, and that the first meeting of the Australasian Association should be held in Sydney in the first week of September 1888. This date was fixed because it will be the hundredth anniversary of the foundation of the colony of New South Wales.

Mr. H. N. RIDLEY, of the British Museum, intends to make an expedition to the island of Fernando Noronha for the purpose of investigating its natural history. The funds for the expedition have been supplied by the Royal Society, and Mr. Ridley hopes to be able to start at the end of February. The marine flora and fauna were collected by the *Challenger* Expedition, but owing to the fact that the island is a Brazilian penal settlement, no naturalists have hitherto been permitted to make collections therein. The Trustees of the British Museum have obtained from the Emperor of Brazil the necessary permission for Mr. Ridley's exploration of the island, which, from what little is known of it, and from its geographical position, promises to be of exceptional interest from a natural history point of view.

THE death is announced, at Victoria, British Columbia, of Dr. W. F. Tolmie. Dr. Tolmie's name has been favourably known to ethnologists for many years in connection with his researches respecting the Indian tribes of British Columbia and neighbouring parts of the Pacific coast, where he has been almost continuously resident since 1833. Dr. Tolmie was a native of Inverness, but in 1832 accepted an appointment as medical officer to the Hudson's Bay Company at Fort Vancouver on the Columbia River, and subsequently became a chief factor in the Company's service. Information supplied by him to Mr. George Gibbs and other ethnologists has appeared in various publications. In 1884 he published, in conjunction with Dr. G. M. Dawson, a nearly complete series of short vocabularies of the principal languages spoken in British Columbia. He has had for many years a larger work in contemplation on the traditions and folk-lore of the same tribes, but the materials for it were not complete at the time of his death.

CHARLES SHALER SMITH, the distinguished engineer, died at his home in St. Louis, Mo., on December 19, 1886. He had been suffering from the effects of a fall, which resulted in serious injuries. From the first his case was considered very grave, but his great vital powers enabled him to keep up for two years.

MR. CLEMENT WRAGGE, late of Ben Nevis Observatory, and now of Adelaide, is to be appointed Meteorologist to the Government of Queensland.

YESTERDAY Prof. A. W. Reinold, F.R.S., delivered at John Street, Adelphi (the Society of Arts), the first of the usual short course of lectures adapted for a juvenile audience. The subject was "Soap Bubbles." The second lecture will be given on January 12.

THE lectures founded by Sir Thomas Gresham will be read to the public gratuitously on the following days, at Gresham College, Basinghall Street, in the subjoined order, beginning each evening at 6 o'clock:—Rhetoric (Mr. J. E. Nixon), January 18, 19, 20, and 21; law (Dr. Abdy), January 25, 26, 27, and 28; geometry (Dean Cowie), February 1, 2, 3, and 4; physic (Dr. Symes-Thompson), February 8, 9, 10, and 11; divinity (Dean Burgon), February 15, 16, 17, and 18; astronomy (the Rev. E. Ledger), February 21, 22, 24, and 25; and music (Dr. H. Wylde), March 1, 2, 3, and 4.

THE complaint is frequently heard that natural science does not get adequately encouraged in Oxford. Six weeks ago a notice was issued by Queen's College that an examination would be held on March 1, 1887, for the purpose of filling up various Scholarships and Exhibitions, including one Scholarship for mathematics and another for natural science. This notice was inserted in various newspapers, of which copies were sent to upwards of a hundred schools in England. The result is that *one* candidate has signified his intention of offering himself for examination in natural science. No doubt there will be at least ten candidates for the vacancy in mathematics, and twenty for each vacancy in classics. This certainly does not show a demand for natural science scholarships in excess of the supply.

ON December 9 the Council of the College of Surgeons adopted, and ordered to be entered on the minutes, a report from the Committee, recommending that the Committee's powers should be enlarged, with a view to the extension of the museum and the library, and the addition of work-rooms. It was also recommended that the Committee should receive power to take other improvements into consideration, and to inquire to what extent an increase of the staff would be rendered necessary by the proposed changes. The improvements, it is believed, would be paid for out of the Erasmus Wilson legacy. The scheme is likely to meet with some opposition, and before finally deciding on a matter of so much importance the Council would do well, as the *British Medical Journal* suggests, to submit its plans to the Fellows.

WE regret to notice that objection is being made in Hong Kong to the expense of publishing in the official gazette the Monthly Weather Reports of the Observatory there. These tables, which have frequently been noticed in these columns, contain the usual statistics of evaporation, radiation, the relative humidity and tension of aqueous vapour, the classification of clouds, and other meteorological details. The local critics say that these are of no practical value; but they surely forget that similar tables are published by every Observatory in the world. The Tokio and Siccawei establishments, to select two which are nearest to Hong Kong, publish periodically the same meteorological statistics, and it is therefore sincerely to be hoped that Dr. Doberck will be permitted to pursue his arduous and useful labours. The colony handsomely voted a sufficient sum for an Observatory a few years ago without question, and the work which it has since done is appreciated in Europe. Only a few weeks since we printed a paper by Dr. Doberck on the typhoons of the China seas, which was essentially and directly practical, for it told the mariner of the various classes of these storms, their direction, and course, and the time at which they are most prevalent. It further explained how vessels caught in these typhoons may best minimise or escape altogether from their evil effects. All this information, the value of which for the protection of life and property, can be appreciated nowhere better than in Hong Kong, with its enormous shipping trade, is obtained only by the careful and sedulous collection and collation of statistics. The physical position of Hong Kong renders its Observatory one of considerable importance in meteorological science, and it is the duty of the colonial Government to see that the institution is not allowed to decline from the high standard which it has already attained.

THE ideas of some Americans as to the education of women seem to be very far ahead of those which still prevail in this country. At Northampton, near Amherst, an observatory is being built by the Trustees of Smith College for young women. Mr. David P. Todd, Director of the Amherst College Observatory, has lately devoted much time to the plans for the construction and equipment of this building, taking care that it shall be thoroughly fitted for the purposes of collegiate instruction, and that it shall contain ample facilities for research.

A SOCIETY for the promotion of the higher education of women has been founded in Japan, under the presidentship of the Prime Minister, and with the support of various influential foreign and Japanese gentlemen. Besides regular courses of instruction which will be provided, special courses of afternoon lectures will be delivered by the professors of the University. The whole institution will be under the control of a foreign lady principal, assisted by two or more foreign lady teachers. Although female education in Japan has already reached an advanced stage, this appears to be the first attempt to provide for the higher education of women, as understood in European countries.

THE late Mr. Greenleaf, the Boston hermit, left the whole of his fortune—probably amounting to five hundred thousand dollars —to Harvard College. The conditions imposed by him are said to be not unreasonable, but it would have been better, as *Science* urges, if he had imposed no conditions whatever. Wealthy men who think of bequeathing money to learned institutions apparently find it hard to realise that the authorities of those institutions are likely to be the most competent judges of the way in which the money should be spent. The needs of Harvard College were certainly not so well known to Mr. Greenleaf as to its President and Faculty.

THE other day *Science* commented on the fact that advertisements calling for applications for vacant Chairs in leading educational institutions are often inserted in educational and literary journals in England. This is never done in the United States. There were no fewer than forty applications for a recent vacancy in a prominent American college, and if the appointment had been advertised, the number would no doubt have been very much larger. *Science* is of opinion that American colleges lose nothing by declining to follow the English example in this matter, since in the case of every important college "the president and trustees keep their eyes continually open, and when a vacancy occurs they are pretty sure to know who is the best man for the place, or, in any event, they have made up unconsciously a short list from which the selection is to be made." A distinct advantage of the American plan is that governing bodies are not troubled with the importunities of persons who wish to be appointed to positions for which they are wholly unsuited.

THE Wagner Free Institute of Science, Philadelphia, has issued a valuable report, by Mr. Angelo Heilprin, on his explorations on the west coast of Florida and in the Okeechobee Wilderness. Mr. Heilprin is of opinion that the whole State of Florida belongs exclusively to the Tertiary and post-Tertiary periods of geological time, and consequently, as a defined geographical area, represents the youngest portion of the United States. There is not, he thinks, a particle of evidence supporting the coral theory of the growth of the peninsula. Sedimentation and deposition along this portion of the American coast appear to have been practically unbroken or continuous, as is indicated by the gradational union of the different formations, and the absence of broad or distinct lines of faunal separation. The elevation of the peninsula, especially in its more southern parts, seems to have been effected very gradually, judging from the perfect preservation of most of the later fossils, and the normal positions—*i.e.*, the positions they occupied when living—which many of the species still maintain. There is evidence that before its final elevation a large part of the peninsula was for a considerable period in the condition of a submerged flat or plain, the shallows covering which were most favourably situated for the development of a profuse animal life, and permitted of the accumulation of reef-structures and of vast oyster and scallop banks. The present submerged plain or plateau to the west of the peninsula may be taken to represent this condition. Fresh-water streams, and consequently dry land, existed in the more southern part of the peninsula during the Pliocene period, as is proved by the inter-association of marine and fluviatile mollusks in the deposits of the Caloosahatchie. Mr. Heilprin holds that the doctrine of evolution receives positive and most striking confirmation in Florida, because the modern fauna of the coast is indisputably a derivative, through successive evolutionary changes, of the pre-existing faunas of the Pliocene and Miocene periods of the same region; and the immediate ancestors of many of the living forms, but slightly differing in specific characters, can be determined among the Pliocene fossils of the Caloosahatchie. He is also convinced that man's great antiquity on the peninsula is established beyond a doubt, and he suggests that the fossilised remains found on Sarasota Bay, now wholly converted into limonite, may represent the most ancient belongings of man that have ever been discovered.

AN interesting paper on the sub-genus Cylinder (Montfort) of Conus, contributed by Mr. J. Cosmo Melvill, M.A., F.L.S., to the tenth volume of the third series of Memoirs of the Manchester Literary and Philosophical Society, has been reprinted. Mr. Melvill has much to say about the *Conus gloria maris.* This exquisite shell is "prominent among all its kindred for beauty of shape and excellence of pattern;" and "the reticulations are so fine as to defy the skill of the lithographer." The land of its nativity is Jacna, island of Bohol, Philippines, where the late Mr. Hugh Cuming found two examples, one very juvenile, scarcely more than an inch in length. Mr. Cuming tried hard to find other specimens, employing all the available natives in dredging expeditions; but his efforts were unsuccessful. It is said that the original very circumscribed locality has been annihilated by an earthquake, and Mr. Melvill thinks that this is not improbable. Only twelve specimens are known to exist. Five are in this country, and one of them is in Mr. Melvill's collection at Prestwich. Another—perhaps the finest specimen known—is in the collection which belonged to the late Mrs. De Burgh, and three are in the British Museum collection at South Kensington. A good example was bought by Mr. Lovell Reeve in 1865 for the Melbourne Museum.

WE have received a "List of the Macro-Lepidoptera of East Sussex," compiled by Mr. J. H. A. Jenner, F.E.S., Lewes. It is reprinted from the Proceedings of the Eastbourne Natural History Society. East Sussex, according to Mr. Jenner, is probably one of the richest, in number of species, in the country. This he attributes to the southern latitude of the district and its varied characteristics—its downs, marshes, extensive woods and forests, and its sea-coast. Some parts of East Sussex have been well worked by entomologists, especially near the larger towns, but little is known of some of the outlying districts.

AMONG the numerous forms of fungus which live upon higher plants (many of which are so detrimental to their hosts) are some, it is now believed, which live with these on terms of mutual assistance. Frank found that the young root points of some of our forest trees, as the beech and the oak, are covered with a coating of fungus (probably belonging to the truffle or allied family), which seems to help in the nutrition of those trees. Another interesting case is that of fungi which live with orchids, and whose mode of propagation has lately been established by Herr Wahrlich (*Botanische Zeitung*). The fungus appears in the outer cells of the root tissue in the form of yellow bladder-like balls (of the nature of *haustoria* or suckers) surrounded by numerous filaments. It works no perceptible harm to the plant, but on the contrary it is thought that, especially in the case of orchids which live on the humus of woods, the fungus probably transforms the humus matters into such as are more easily utilised by the orchid, thus doing it a physiological service. The fungi observed by Herr Wahrlich belong to the family of *Pyrenomycetes*, and the genus *Nectria.*

THE amount of free carbonic acid in the ground has been lately shown by Prof. Wollny (we learn from *Naturforscher*) to depend, on the one hand, on the factors of decomposition of organic substances (heat, moisture, porosity), as affected by the physical nature of the ground and its covering; on the other hand, on the resistance which the ground presents, according to its mechanical state, to the escape of the gas. Ground-air seems to have most carbonic acid when the ground is at a slope of about 20°. Slopes facing south have most carbonic acid; those facing north, least, though the difference is not great, as the two principal factors, heat and moisture, largely counteract each other. In drought, ground facing north has more carbonic acid. With equal quantities of organic matter there is more carbonic acid, the more finely granular the ground; and such ground hinders movement of the gas downwards as well as into the atmosphere. The air in ground shaded by living plants has considerably less carbonic acid than that in bare ground, and in the latter it has less (in dry years, not in wet) than in ground covered by dead parts of plants.

IN lecturing upon the "Denizens of the Aqueous Kingdom" on Friday last at the Royal Aquarium, Mr. August Carter referred to deformities that exist among fish. In 1885 and 1886 he had examined many thousands of trout and salmon fry at South Kensington on their emerging from the ova, and found one case of deformity in every thousand, and one case of monstrosity, such as twin and dual-headed fish, in every four thousand. From observations he had made at the South Kensington Aquarium and elsewhere, the lecturer concluded that certain fish, such as the carp and perch, have the power of communicating with one another.

Whilst collecting fish ova from the River Colne for the hatchery at the Delaford Fish Culture Establishment, the water-bailiffs found an "egg-bound" trout, that is, one that had died through being unable to extrude its eggs. It was brought to Mr. W. Oldham Chambers, who on examination found the ova to be thoroughly healthy, although the fish, judging from its decomposed state, must have been dead about three weeks. He at once obtained a milter, and succeeded in impregnating the ova, which appear to be quite healthy and capable of incubation. The spawning season has been greatly retarded by the extreme severity of the weather.

We have received the first number of the *Cycling Budget*, the editors of which undertake to keep cyclists "thoroughly well posted in every imaginable topic which may be of service to them." There are to be careful analytical descriptions of every new or modified type of machine as it comes into the market. The *Budget* advocates the building of a club-house for cyclists in London. In America, it appears, there are magnificent club-houses for "the votaries of the pastime."

During the year ended October 31, 1886, the total quantity of steel and ingot iron made from phosphoric pig was 1,313,631 tons, of which 927,284 tons were ingot iron containing under ·17 per cent. of carbon. As compared with the make of the previous twelve months, there was an increase of about 368,314 tons. The total quantity produced represents about 394,000 tons of slag, containing from 30 to 35 per cent. of phosphate of lime. Most of the basic slag made in Germany is finely ground, and used in place of superphosphates.

M. Alfred Marche, who has already been despatched on more than one scientific mission to distant regions on behalf of the French Ministry of Public Instruction, left Marseilles on the 19th ult., on a similar errand, for the Marianne Islands.

M. Thouar's expedition to solve the question of the navigability of the Pilcomayo, and its suitability as a trade route between Bolivia and the eastern parts of South America, has had to be postponed so far as the upper waters are concerned, owing to the refusal of the Bolivian Government at present to supply its share of the funds for the undertaking. Writing, however, from Suere on October 22, M. Thouar reports that the Bolivians have confided to him a mission of exploration in the same regions. He is to cross the Bolivian Chaco and survey it, with a view to discovering a land route for trade, and also to make a scientific investigation of the territory on the right bank of the Paraguay, directing especial attention to its capacity for cultivation and to the methods by which immigration should be encouraged. M. Thouar was to start on this mission about November 18.

The *Annuaire pour l'An* 1887, issued by the Bureau des Longitudes, Paris, contains much astronomical and other scientific information, arranged in a convenient form. The work is carefully edited, and has been considerably enlarged, by M. Loewy, one of the members of the Bureau.

The current number of the *Memorie della Società degli Spettroscopisti Italiani* contains a good portrait of the late Alessandro Dorno, with a brief sketch of his career. Dorno was born at Asli on February 13, 1825. He had scarcely taken his degree at the University of Turin in 1848 when he was appointed Professor of Mechanics at the Military Academy there. In 1865 he was made Professor of Astronomy at the University of Turin and Director of the Observatory. Many papers by him appeared in the Transactions of the Turin Academy of Sciences, and he was a frequent contributor to the various scientific journals. In 1874 he took part in the scientific expedition to India for the observation of the transit of Venus. He died at the Villa di Borgo, San Pietro, near Turin, on August 19, 1886.

We have received Parts 16-20 of the "Länderkunde des Erdteils Europa," which is being issued at Leipzig and Prague. This admirable work is edited by Dr. A. Kirchhoff, who has secured the co-operation of many eminent geographers. There are numerous illustrations, all of which are carefully executed.

We print to-day an abstract of an excellent paper on "The Use and Equipment of Engineering Laboratories," by Prof. A. B. W. Kennedy, M.Inst.C.E., read at the ordinary meeting of the Institution of Civil Engineers on Tuesday, December 21, 1886.

With regard to the postscript to his letter on "Electricity and Clocks," in our last number (December 30, 1886, p. 198), Mr. Henry Dent Gardner writes to us that it is the weak spring, not the hammer, which should be kept away from a banking.

The additions to the Zoological Society's Gardens during the past week include two Green Lizards (*Lacerta viridis*), a Slow-worm (*Anguis fragilis*), European, presented by Mr. R. M. J. Teil; a Yellow-footed Rock-Kangaroo (*Fetrogale xanthopus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

The Andromedes, November 27, 1886.—P. F. Denza, writing in *Cosmos* under date December 2, gives the results of the watch maintained on the night of November 27 last at seven observatories distributed over the Italian peninsula. All the reports alike agree in showing that there was no repetition of the shower of 1885, the number of meteors observed being no greater than on an ordinary night, and of these the majority radiated from Perseus and Taurus, only very few from the radiant of the Andromedes. It follows, therefore, from these observations and those of 1873 and 1885, that the meteoric cloud giving rise to the shower is of comparatively small extent, but very dense. This fact tends to confirm the theory of the recent formation of the stream and of its origination in the disintegration of Biela's comet. The interval, thirteen years, between 1872 and 1885, corresponds to two revolutions of the comet; but the earth was in quite a different part of its orbit at the date of the intermediate return, and therefore no shower was witnessed.

The Reduction of the Positions of Close Polar Stars from one Epoch to another.—A paper containing a catalogue of 130 Polar stars for the epoch 1875·0, resulting from all the available observations made between 1860 and 1885, and reduced to the system of the Catalogue of Publication xiv. of the Astronomische Gesellschaft, has been communicated to the American Academy of Arts and Sciences by Prof. W. A. Rogers and Miss Anna Winlock. The first section of this work, giving an investigation of the methods of reducing the positions of close Polar stars from one epoch to another, has been published in the Memoirs of the Academy, vol. xi. part 4, No. 5. And Prof. Rogers chivalrously appends a note to the effect that his connection with the work is limited to the methods of discussion adopted, and to an examination of the numerical results obtained; and that beyond this all the work in the preparation of the paper has been done by Miss Winlock, who is entitled to all the credit therefor. By the laborious process of actual computation, taking the instance of Groombridge 1119—a star situated within 1° of the Pole, it is shown that it is impossible to obtain an exact agreement between the values of the precessional motion computed by Taylor's theorem and the corresponding values computed from the rigorous trigonometrical formulæ, in the case of such a star, when the time exceeds forty years. But it is also shown that the time at which the values derived from the development by Taylor's theorem begin to deviate from those derived from the rigorous formulæ may be extended many years by means of a secondary series, which represents the residuals